

CLAIMS

What is claimed is:

1. A catalytic cracking catalyst comprising catalytically effective amounts of:
 - (a) a first molecular sieve having an intermediate pore size; and,
 - (b) a second molecular sieve having a structure type that is different from said first molecular sieve and a pore size index of at least one channel of said second molecular sieve which is less than the pore size index of at least one channel of said first molecular sieve.
2. The catalytic cracking catalyst recited in Claim 1, wherein the second molecular sieve has a pore diameter greater than about 3.5 Å.
3. The catalytic cracking catalyst recited in Claim 1, further comprising a third molecular sieve having a large pore size.
4. The catalytic cracking catalyst recited in Claim 1, wherein all of the channels of the second molecular sieve have a pore size index that is less than the pore size index of all of the channels of the first molecular sieve.
5. The catalytic cracking catalyst recited in Claim 2, wherein said first molecular sieve and said second molecular sieve have one dimensional, non-interconnecting channels.
6. The catalytic cracking catalyst recited in Claim 2, wherein said first molecular sieve, said second molecular sieve, or both have three-dimensional, interconnecting channels.

7. The catalytic cracking catalyst recited in Claim 2, wherein said first molecular sieve has a structure selected from the group consisting of ITH, MFI, MEL, MFS MTW, and MWW.
8. The catalytic cracking catalyst recited in Claim 2, wherein said first molecular sieve is selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-57, ITQ-13, and MCM-22.
9. The catalytic cracking catalyst recited in Claim 1, wherein said second molecular sieve has a structure selected from the group consisting of AEL, AFO, CHA, TON, FER, MTT, and MWW.
10. The catalytic cracking catalyst recited in Claim 8, wherein said second molecular sieve is selected from the group consisting ECR-42, ZSM-22, ZSM-35, ZSM-23, MCM-22, MCM-49, SAPO-11, SAPO-34, and SAPO-41.
11. The catalytic cracking catalyst recited in Claim 1, wherein said first molecular sieve is ZSM-5 and said second molecular sieve is SAPO-11.
12. The catalytic cracking catalyst recited in Claim 9, wherein said third molecular sieve has a structure selected from the group consisting of AFI, AFR, LTL, VFI, MAZ, MEI, FAU, EMT, OFF, *BEA, and MOR.
13. The catalytic cracking catalyst recited in Claim 12, wherein said third molecular sieve is selected from the group consisting of faujasite, mazzite, offretite, zeolite L, VPI-5, SAPO-37, zeolite X, omega, Beta, ZSM-3, ZSM-4, ZSM-18, ZSM-20, MCM-9, MCM-41, MCM-41S, MCM-48, zeolite Y, Ultrastable Y, Rare Earth exchanged Y, Rare Earth exchanged USY, Dealuminated Y, and Ultrahydrophobic Y.

14. The catalytic cracking catalyst recited in Claim 2, wherein said first molecular sieve is an aluminosilicate zeolite.

15. The catalytic cracking catalyst recited in Claim 2, wherein said catalyst further comprises a binder.

16. The catalytic cracking catalyst recited in Claim 2, wherein said first molecular sieve and said second molecular are present in said catalyst in an amount such that the weight ratio of first molecular sieve to second molecular sieve is in the range from about 0.1 to about 10.

17. The catalytic cracking catalyst recited in Claim 2, wherein the particles of the first molecular sieve and said second molecular sieve has an average crystal size in the range from about 0.1 to about 3 micrometers.

18. The catalytic cracking catalyst recited in Claim 9, wherein said third molecular sieve is Ultrastable Y, Rare Earth exchanged Y, Rare Earth exchanged USY, Dealuminated Y, and Ultrahydrophobic.

19. A catalytic cracking process for selectively producing C₃ olefins, said process comprising contacting under catalytic cracking conditions, a feedstock containing hydrocarbons having at least 5 carbon atoms with a catalytic cracking catalyst comprising catalytically effective amounts of:

(a) a first molecular sieve having an intermediate pore size; and,

(b) a second molecular sieve having a structure type that is different from said second molecular sieve and a pore size index of at least one channel of said second molecular sieve which is less than the pore size index of at least one channel of said first molecular sieve.

20. The process recited in Claim 19, wherein said feedstock comprises a naphtha having a boiling range of 25°C to 225°C.
21. The process recited in Claim 20, wherein the second molecular sieve has a pore diameter greater than about 3.5 Å.
22. The process recited in Claim 20, wherein all of the channels of the second molecular sieve have a pore size index that is less than the pore size index of all of the channels of the first molecular sieve.
23. The process recited in Claim 20, wherein said first molecular sieve and said second molecular sieve have one dimensional, non-interconnecting channels
24. The process recited in Claim 20, wherein said first molecular sieve, said second molecular sieve, or both have three-dimensional, interconnecting channels.
25. The process recited in Claim 20, wherein said first molecular sieve has a structure selected from the group consisting of ITH, MFI, MEL, MFS MTW, and MWW.
26. The process recited in Claim 25, wherein said first molecular sieve is selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-57, ITQ-13, and MCM-22.
27. The process recited in Claim 25, wherein said second molecular sieve has a structure selected from the group consisting of AEL, AFO, CHA, TON, FER, MTT, and MWW.

28. The process recited in Claim 26, wherein said second molecular sieve is selected from the group consisting ECR-42, ZSM-22, ZSM-35, ZSM-23, MCM-22, MCM-49, SAPO-11, SAPO-34, and SAPO-41.

29. The process recited in Claim 20, wherein said first molecular sieve is ZSM-5 and said second molecular sieve is SAPO-11.

30. The process recited in Claim 29, wherein said naphtha is a thermally or catalytically cracked naphtha boiling in the naphtha range and containing from about 5 wt. % to about 35 wt. % paraffins, and from about 15 wt. % to about 70 wt. % olefins.

31. The process recited in Claim 21, wherein the catalytic cracking conditions include a feed residence time in the reaction zone of less than about 10 seconds, temperatures ranging from about 400° C. to about 700° C.; hydrocarbon partial pressures from about 10 to 50 psia; and a catalyst to feed (wt/wt) ratio from about 3 to 12; wherein catalyst weight is total weight of said catalytic cracking catalyst composite.

32. The process recited in claim 19, wherein the feedstock comprises a hydrocarbon mixture having an initial boiling point of 200°C and said catalytic cracking composition further comprises a third molecular sieve having a large pore size.

33. The process recited in Claim 32, wherein all of the channels of the second molecular sieve have a pore size index that is less than the pore size index of all of the channels of the first molecular sieve.

34. The process recited in Claim 32, wherein said first molecular sieve and said second molecular sieve have one dimensional, non-interconnecting channels.

35. The process recited in Claim 32, wherein said first molecular sieve, said second molecular sieve, or both have three-dimensional, interconnecting channels.

36. The process recited in Claim 32, wherein said third molecular sieve has a structure selected from the group consisting of AFI, AFR, LTL, VFI, MAZ, MEI, FAU, EMT, OFF, *BEA, and MOR.

37. The process recited in Claim 32, wherein said first molecular sieve has a structure selected from the group consisting of ITH, MFI, MEL, MFS MTW, and MWW.

38. The process recited in Claim 37, wherein said first molecular sieve is selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-57, ITQ-13, and MCM-22.

39. The process recited in Claim 37, wherein said second molecular sieve has a structure selected from the group consisting of AEL, AFO, CHA, TON, FER, MTT, and MWW.

40. The process recited in Claim 37, wherein said second molecular sieve is selected from the group consisting of ECR-42, ZSM-22, ZSM-35, ZSM-23, MCM-22, MCM-49, SAPO-11, SAPO-34, and SAPO-41.

41. The process recited in Claim 32, wherein said first molecular sieve is ZSM-5 and said second molecular sieve is SAPO-11.

42. The process recited in Claim 39, wherein said third molecular sieve has a structure selected from the group consisting of AFI, AFR, LTL, VFI, MAZ, MEI, FAU, EMT, OFF, *BEA, and MOR.

43. The process recited in Claim 40, wherein said third molecular sieve is selected from the group consisting of faujasite, mazzite, offretite, zeolite L, VPI-5, SAPO-37, zeolite X, omega, Beta, ZSM-3, ZSM-4, ZSM-18, ZSM-20, MCM-9, MCM-41, MCM-41S, MCM-48, zeolite Y, Ultrastable Y, Rare Earth exchanged Y, Rare Earth exchanged USY, Dealuminated Y, and Ultrahydrophobic Y.

44. The process of Claim 43, wherein said large pore molecular sieve is selected from the group consisting of REY, USY or REUSY.

45. The process of Claim 44, wherein said hydrocarbon mixture has an initial boiling point above 200°C, a 50 % point of at least 260°C and an end point of at least 315°C.

46. The process of Claim 45, wherein said hydrocarbon mixture is selected from the group consisting of vacuum gas oils, thermal oils, residual oils, cycle stocks, whole top crudes, tar sand oils, shale oils, synthetic fuels, heavy hydrocarbon fractions derived from the destructive hydrogenation of coal, tar, pitches, asphalts, and hydrotreated products of the foregoing.

47. The process of Claim 44, wherein the weight ratio of said third molecular sieve to the first and second molecular sieve is about 0.01 to about 0.1.

48. The process of Claim 41, wherein said large pore molecular sieve comprises a zeolite Y.

49. The process recited in Claim 41, wherein the product of said catalytic cracking process contains at least 5 percent by weight of C₃ olefins based on the total weight of the propylene and butylene produced by the process.

50. The process recited in Claim 41, wherein said process is carried out to produce propylene in a propylene to ethylene ratio of at least 4:1 and a propylene to butylene ratio of at least 1:1.

51. The process recited in Claim 50, further comprising the steps of: (a) separating the propylene; and (b) polymerizing or co-polymerizing the separated propylene.

52. The propylene-containing product recited in Claim 51.